

(i.e., when the stored known coordinate system are achieved). A display on the instrument (second sensor **810**) can be used to help with the orientation procedure as shown in FIG. **31** (real time tracking and display of the orientation of the object to which the second sensor is attached). Alternatively, a series of numerical values could be on the display **820** to indicate when the target orientation has been reached. Once the cup has been impacted and its orientation verified, the first sensor **800** can be removed from the acetabulum **103**.

In one embodiment, the sensors **800**, **810** can thus communicate with a computer (machine) that executes software such as 3D positioning (coordinate) software and the 3D coordinates of the sensors **800**, **810** are tracked and displayed on display **820**. In this configuration, the sensors **800**, **810** communicate with the computer system.

While the invention has been described in connection with certain embodiments thereof, the invention is capable of being practiced in other forms and using other materials and structures. Accordingly, the invention is defined by the recitations in the claims appended hereto and equivalents thereof. What is claimed is:

1. A method for forming a patient-specific acetabular guide for use in orienting an acetabular component with respect to an acetabulum of a patient as part of a surgical procedure, the method comprising the steps of:

- obtaining at least one image of the patient including at least 3D image data of a pelvic region of the patient;
- constructing a three-dimensional (3D) virtual model of an acetabulum of the patient based on the 3D image data of the pelvic region and based on a prescribed orientation of the acetabular component;
- constructing an initial patient-specific virtual acetabular guide;
- performing one or more modeling operations on the initial patient-specific virtual guide in view of the 3D virtual model of the acetabulum so as to form a final patient-specific virtual guide which has a bottom surface which has a portion that is shaped and configured based on the 3D virtual model of the acetabulum to intimately receive and interlockingly mate with an acetabular notch of the patient's acetabulum for attaching the patient-specific guide to the acetabulum according to the prescribed orientation; and
- forming the patient-specific acetabular guide based on the final patient-specific virtual guide.

2. The method of claim 1, wherein the step of constructing the initial patient-specific virtual acetabular guide comprises the step of first fitting a sphere to a lunate surface of the three-dimensional model of the acetabulum and then subsequently inserting a hemisphere into the three-dimensional model of the acetabulum at a center of the sphere and at the prescribed orientation, the hemisphere having a diameter greater than a diameter of the sphere.

3. The method of claim 1, wherein the step of performing one or more modeling operations on the initial patient-specific virtual guide includes the steps of:

- offsetting the lunate surface of the three-dimensional model of the acetabulum by a first predetermined distance; and
- performing at least one Boolean operation between the hemisphere and the offset three-dimensional model of the acetabulum to remove portions of the hemisphere that are in interference with a bony surface of the 3D virtual model of the acetabulum.

4. The method of claim 1, wherein the step of performing one or more modeling operations on the initial patient-specific virtual guide comprises the step of removing portions of

the initial patient-specific virtual guide that are in interference with bony surface of the 3D virtual model of the acetabulum.

5. The method of claim 4, wherein the one or more modeling operations comprises a plurality of Boolean operations that are performed sequentially on the three-dimensional model of the acetabulum, wherein a second Boolean operation and any Boolean operations performed subsequent thereto are performed subsequent to the three-dimensional model of the acetabulum being incrementally translated along an center axis.

6. The method of claim 5, wherein the three-dimensional model of the acetabulum is translated along the center axis in a plurality of increments, each increment being about 1 mm.

7. The method of claim 5, wherein at least three Boolean operations are performed and incremental translation of the three-dimensional model of the acetabulum results in the bottom contact surface matching the acetabular notch of the patient's acetabulum but including a sufficient undercut to provide a locking effect between the bottom contact surface and the acetabular notch of the patient's acetabulum.

8. The method of claim 1, further including the step of trimming edges of the patient-specific acetabular guide that extend onto a rim of the patient's acetabulum.

9. A method of pre-operatively planning the implantation of a patient-specific acetabular component comprising the steps of:

- obtaining three-dimensional image data of a pelvic region of the patient;
- using the obtained image data to determine a prescribed orientation of the acetabular component with respect to an acetabulum of the patient, the prescribed orientation being defined by a center longitudinal axis; and
- constructing a three-dimensional model of an acetabular guide from the obtained image data, wherein the three-dimensional model of the acetabular guide includes a contact surface that includes a first portion that is shaped to substantially match an acetabular notch of the patient's acetabulum, wherein a center longitudinal axis of the acetabular guide is co-linear or parallel to the center longitudinal axis of the acetabular component, wherein the acetabular guide is configured such that when the acetabular component obtained from the three-dimensional model is inserted into the acetabulum, the first portion is directly engaged to the acetabular notch and includes a sufficient undercut to provide a locking effect between the first portion and the acetabular notch.

10. A method for implanting an acetabular component in an acetabulum of a patient comprising the steps of:

- inspecting a pre-operative plan including a three-dimensional image of the specific patient;
- selecting a prescribed orientation of the acetabular component;
- constructing a patient-specific acetabular guide having a contact surface that is made to conform to an acetabular notch of the acetabulum of the patient in accordance with the three-dimensional image of the specific patient and the prescribed orientation;
- orienting the patient-specific acetabular guide in the acetabulum of the specific patient such that the contact surface interlocks with the acetabular notch of the patient's acetabulum;
- using the patient-specific guide to orientate a first reference member that defines a reference axis that is parallel to a center axis of the acetabular component; and
- implanting the acetabular component using the first reference member as a reference;